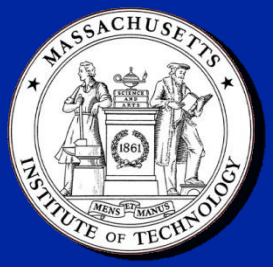
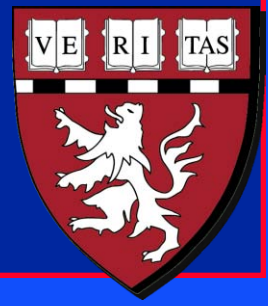


Massachusetts Institute of Technology
Harvard Medical School
Brigham and Women's/Massachusetts General Hosp.
VA Boston Healthcare System



2.79J/3.96J/20.441/HST522J

EPITHELIALIZATION: EPIDERMAL REGENERATION

M. Spector, Ph.D.

TOPICS

- Tissues (epidermis and endothelium) within the same tissue classification (epithelium) behave in similar ways in response to injury and in wound healing
- Even tissues which can regenerate (epithelium) may not do so to fill defects which are too large (greater than the "critical" size)
- The principal roles that biomaterials may play in replacing tissues or facilitating regeneration may differ from one tissue to another in the same tissue classification
  - In some applications the principal beneficial role of the biomaterial may be to just maintain the physiological environment

LESSONS

Biomaterials for the fabrication of temporary wound covering materials

Skin Wounds

Figures showing skin wounds at different depths removed due to copyright restrictions.

Effects of Maintaining a Moist Environment at the Wound Site

“Scab”

Do epithelial cells come only from the edges of the wound?

Source of Epithelial Cells

Diagram removed due to copyright restrictions.
Epidermal cells moving through the outer root sheath around a hair shaft.

Hydrogel: Geliperm ©

Photos removed due to copyright restrictions.

Polyacrylamide-Agar Interpenetrating Network; 96% water

Particulate form of the hydrogel

Diagrams removed due to copyright restrictions.
“Dry ulcer” and “Exudating ulcer.”

Animal Model: Miniature Pig

- **Certain features of skin similar to human**

Photo of miniature pig in lab test removed due to copyright restrictions.

EPITHELIALIZATION

Full Thickness Burns

Skin Graft Donor Sites

Meshed Grafts

Heated aluminum block applied to skin for a specified time period.

Immediate Post-Op

Hydrogel

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5 days post-op

Hydrogel

Photos of wounds removed due to copyright restrictions.

Dry

Dry

Dry

5 days post-op

Hydrogel

Histology slide photos of healing skin removed due to copyright restrictions.

EPITHELIALIZATION

Full Thickness Burns

Skin Graft Donor Sites

Meshed Grafts

Dermatome

Images removed due to copyright restrictions.

Donor graft being taken from the miniature pig.

Photos removed due to copyright restrictions.

Donor Site

Hydrogel

Two photos (for comparison) removed due to copyright restrictions.

Fine Mesh Gauze Control

5 Days Post-Op

Hydrogel

Gauze

Histology slide photos of healing skin removed due to copyright restrictions.

Human Trial
5 days post-op

Gauze

Hydrogel

Photos of removed due to copyright restrictions.

EPITHELIALIZATION

Full Thickness Burns

Skin Graft Donor Sites

Meshed Grafts

Production of a meshed graft

Images removed due to copyright restrictions.
See http://www.nlm.nih.gov/medlineplus/ency/imagepages/19083.htm

Miniature Pig Model
5 days post-op

Gauze

Hydrogel

Photos of healing skin removed due to copyright restrictions.

Gauze

Miniature Pig Model
5 days post-op

Hydrogel

Histology slide photos of healing skin
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Effect of Keratinocyte Seeding of Collagen-Glycosaminoglycan Membranes on the Regeneration of Skin in a Porcine Model.

Butler, Charles; Orgill, Dennis; Yannas, Ioannis; Compton, Carolyn
Plastic & Reconstructive Surgery. 101(6):1572-1579, May 1998.

- **A collagen-glycosaminoglycan matrix, impregnated with autologous keratinocytes, was applied as island grafts onto full-thickness porcine wounds to determine whether complete epidermal coverage could be achieved in a single grafting procedure.**
- **Grafts with seeding densities ranging from 0 to 3,000,000 cells/cm2 were used to determine the kinetics of epidermal coverage.**
- **Autologous keratinocytes proliferated as the collagen-glycosaminoglycan matrix was vascularized to form a confluent epidermis by 2 weeks in matrices seeded with at least 100,000 cells/cm2.**
- **Irrespective of seeding density at 2 weeks the collagen-glycosaminoglycan matrix was well vascularized, contained a dense cellular infiltrate, and was almost completely degraded. These studies demonstrate that seeded keratinocytes proliferate and differentiate to form a confluent epidermis by 2 weeks in matrices seeded with at least 100,000 cells/cm2.**

Several figures removed due to copyright restrictions.
See Butler, Charles; Orgill, Dennis; Yannas, Ioannis; Compton, Carolyn.
Plastic & Reconstructive Surgery. 101(6):1572-1579, May 1998.

20.441J / 2.79J / 3.96J / HST.522J Biomaterials-Tissue Interactions

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